

Oscillatory Motion



لدورية : هي الحركة التي تتكرر بانتظام ع فترات زمنية متساوية (تنقسم الى حركة اهتزازية و موجية)

Periodic motion

Divided into: oscillatory and wave motion

It is a motion which is regularly repeated in equal periods of time.

الحركة الاهتزازية : هي حركة الجسم المهتز حول نقطة السكون – تتكرر ع فترات زمنية متساوية (نوع من الحركة الدورية)

Oscillatory motion

It is the motion of oscillatory body around its rest point, where the motion is repeated through equal intervals of time.



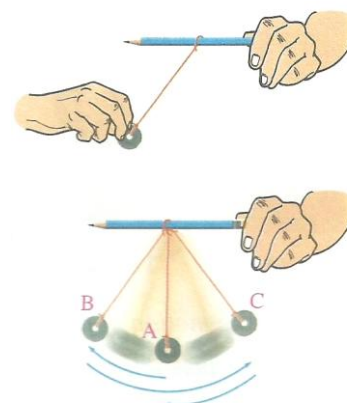
Activity>>> to show the oscillatory motion:

الحركة تتكرر حول موضع السكون ع فترات متساوية – السرعة لها قيمة عظمى عند موضع السكون A

Observation:

1 - The motion is repeated around the original position A in equal time intervals.

2 - The velocity of the body reaches its maximum value by passing its original position A and decrease gradually when it goes far from it.



Conclusion :

The body moves around its rest position, where the motion is repeated through equal intervals of time known as ((Oscillatory motion)).

عند زيادة طاقة الحركة تزداد السرعة (تناسب طردي)

$$\text{The kinetic energy} = 1/2 (\text{mass} \times \text{squared velocity}) = 1/2 mv^2$$

So kinetic energy is **directly proportional** with body velocity. (KE increase - velocity increase)



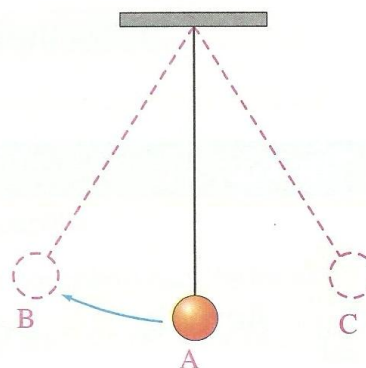
Question?

A: the maximum kinetic energy of pendulum is at point.....

(A / B / C / C,B)

B: the kinetic energy vanishes (equal zero) at points

(A / B / C / C,B)



امثلة الحركة الاهتزازية : الساعة – الشوكة الرنانة – الزنبرك – الالة الوترية – الارجوحة

Examples of Oscillatory motion

Clock --- Tuning fork --- Spring --- Stretched string --- Motion of swing.



Clock



Tuning fork



Spring



Stretched string



Motion of swing

* **Motion of a rotary: it's a periodic motion:** Bec. it's repeated regularly in equal time intervals, **but not** oscillatory motion: Bec. It is not repeated on both sides of its rest point.

تطبيقات ع الحركة الاهتزازية : فرن الميكرويف



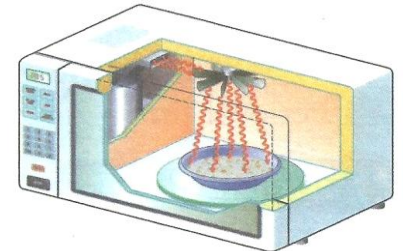
Rotary beater

Application for oscillatory motion

Microwave oven : it is oven used to cook or heat food.

يعتمد ع اهتزاز جزيئات الماء فى الطعام بتأثير موجات الفرن – تتصادم فتننتج طاقة لطهى الطعام بسرعة

** Its function depends on the vibration of water molecules present in food by the effect of microwaves.



Microwave oven

** Vibration ((Oscillatory)) motion causes collision of water molecules, leads to increase of its heat energy that helps cooking food faster.

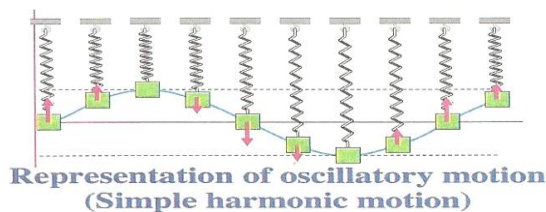
يوضع الطعام فى اناء من الزجاج – الخزف – السيراميك – لا يوضع فى اناء معدنى – لانه يعكس موجات الميكرويف

* When using a **microwave**, food must be put in a container made of **glass, pottery, or ceramic**, and **not in metallic pots** because they reflect microwaves.

الحركة التوافقية البسيطة هى ابسط انواع الحركة الاهتزازية



The **simple harmonic motion** is the simplest form of oscillatory motion.



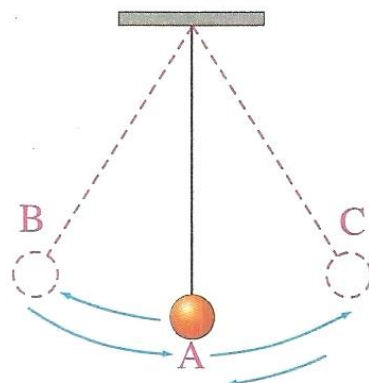
Some concepts of oscillatory motion and its properties.

بعض المفاهيم المرتبطة بالحركة الاهتزازية

1 - Amplitude

The displacements $\vec{AB} = \vec{BA} = \vec{AC} = \vec{CA}$
Each of them is called ((Amplitude)).

سعة الاهتزازة : هي أقصى مسافة للجسم المهتز بعيدا عن نقطة السكون
تقاس بوحدة المتر - سم



Oscillation of pendulum

Amplitude

It is the maximum displacement done by the oscillatory body away from its original position.

** measuring unite is meter and centimeter ((cm)).



What is meant by? >>> The amplitude of an oscillating body is 2 Cm?

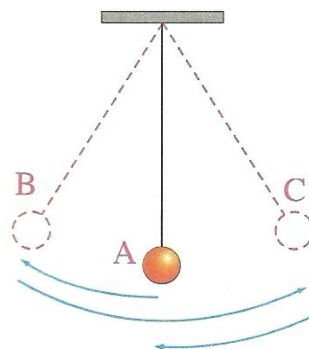
This means that the maximum displacement of the oscillating body away from its original position is 2cm.

2 - complete oscillation.

Complete oscillation means:

$A \rightarrow B \rightarrow A \rightarrow C \rightarrow A$

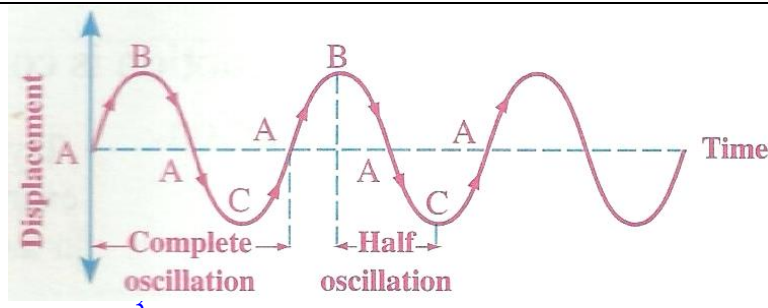
الاهتزازة الكاملة : حركة الجسم المهتز عند مروره بنقطة السكون مرتين متتاليتين
تتكون من 4 سعة اهتزازة



Complete oscillation:

It is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.

** Complete oscillation includes 4 amplitudes.





Exercise:

- 1 - In which graph, the amplitude is larger?
- 2 - How many complete oscillations do exist between the point X and Y represented on both graphs?

1- **Graph 1** 2- **3 and 4 complete oscillations**

الزمن الدوري : هو الزمن اللازم لعمل اهتزازة كاملة (ثانية)

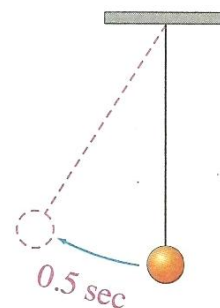
3 - Periodic time

It is the time taken by an oscillating body to make one complete oscillation.

** unite of measurement is second ((sec.)).

لحساب الزمن الدوري

Periodic time = time in seconds / number of complete oscillations.



What is meant by:

The periodic time of oscillating body is 2 seconds?

** This mean that the time taken to make one complete oscillation is 2 seconds.

التردد : عدد الاهتزازات الكاملة في الثانية الواحدة (يقاس بوحدة الهرتز)

4 - Frequency (F)

** It is the number of complete oscillations made by an oscillating body in one second.



Example:

Simple pendulum makes 50 complete oscillations in 10 sec.

This mean that number of complete oscillations / second = $50/10 = 5$

So frequency = 5 oscillations / second

لحساب التردد

The frequency = number of complete oscillations / time in seconds.

** Unit of frequency is **Hertz ((Hz))**.

Kilohertz = 1×10^3 <<>> **megahertz** = 1×10^6 <<>> **gigahertz** = 1×10^9

العلاقة بين التردد والزمن الدوري (علاقة عكسية)



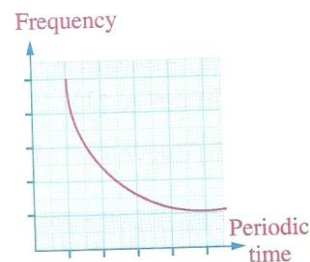
The relation between frequency and periodic time



$$\text{Frequency} \times \text{periodic time} = 1$$

$$\text{Frequency (F)} = 1 / \text{periodic time (T)}. \quad \& \quad \text{periodic time (T)} = 1 / \text{frequency (F)}.$$

** There is an **inverse relationship** between frequency and periodic time.



Problems

1 - Calculate periodic time and frequency for an oscillating body that makes 300 complete oscillation in half minute?

Solution:

$$\text{Time} = 0.5 \times 60 = 30 \text{ seconds.}$$

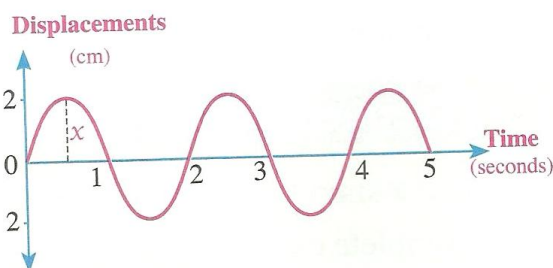
$$\text{Periodic time (T)} = 30 / 300 = 0.1 \text{ second.}$$

$$\text{Frequency (F)} = 1 / (T) = 1 / 0.1 = 10 \text{ Hz.}$$



2 - From the opposite figure calculate:

- Amplitude = 2 cm
- Periodic time = 2 sec.
- Frequency = 0.5 Hertz





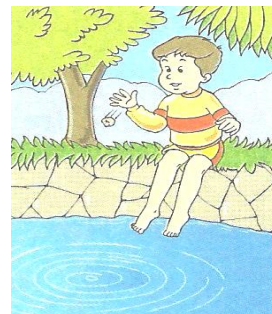
Wave motion

الحركة الموجية : عند القاء حجر في الماء تنتشر الموجات ع سطح الماء

**** you know that motion is an example of periodic motion.**

**** If you throw a stone in water, concentric circles propagate on the water surface.**

This motion represents wave motion.



The role of waves in transferring energy

عند دفع القطعة الاولى كل القطع تسقط دون ان تتحرك من مكانها

Activity defining the concept of wave and its role in energy transfer:

Procedures:

- 1 - Arrange the dominoes' pieces in a row at equal distances.
- 2- Push the first piece.



Dominoes' pieces

Observation:

The pieces fall one after the other, and don't change their positions.

القطعة الاولى تنقل الطاقة الى الثانية ثم الثالثة ويستمر انتقال الطاقة

Explanation:

- 1 - When the first domino piece falls, it will transfer its energy to the second piece which falls transferring its energy to the third and so on.
- 2 - Transfer of energy continues.

Conclusion:

The disturbance that propagates and transfers energy in the direction of propagation is known as the wave.

الموجة : اضطراب ينتشر وينقل الطاقة في اتجاه الانتشار

The wave:

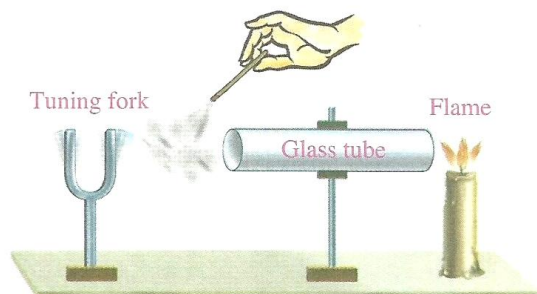
It is the disturbance that propagates and transfers energy in the direction of propagation.

مفهوم الحركة الموجية

The concept of wave motion:

Activity concluding the concept of wave motion:

عندما تهتز الشوكة الرنانة (عود من البخور) فإن لهب الشمعة يهتز (موجات الصوت نقلت الطاقة الى الشمعة)
 دخان البخور لم يدخل الانبوبة (جزيئات الهواء نقلت الطاقة) دون ان تتحرك من مكانها



Procedures:

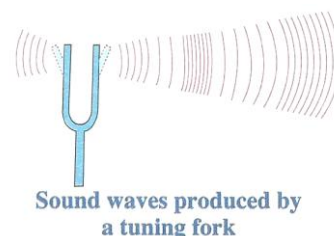
- 1 - Fix horizontally the glass tube.
- 2 - Put the burning candle at one end of the tube.
- 3 - Tab the tuning fork and let it vibrate at the other end of the tube near burning incense stick.

Observation:

- 1 - The flame of candle vibrates.
- 2 - Sound waves have transferred energy from vibrating tuning fork to the candle flame.
- 3 - Vapour of burning incense stick does not enter the tube which indicates the air molecules do not move with the sound waves through the tube.

Explanation:

- 1 - Energy is generated when tuning fork vibrates. This energy is transferred in the form of sound waves.
- 2 - The medium particles (air and smoke particles) do not move from their places during the propagation of sound waves which carry energy to the candle flame.



Conclusion:

The movement resulting from the vibration of the medium particles at a certain moment in a specific direction is known as wave motion.

الحركة الموجية : الحركة الناتجة من اهتزاز جزيئات الوسط (الهواء) عند لحظة معينة وفي اتجاه معين

Wave motion:

It is the motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction.

خط انتشار الموجة : هو اتجاه انتشار الموجة

The line of wave propagation:

It is the direction through which the wave propagates.

جزيئات الوسط لا تتحرك (تهتز فقط لنقل الطاقة) في اتجاه انتشارها

Remember: in wave motion:

- ** Medium particles don't move from their positions, but they vibrate only.
- ** The wave propagates carrying the energy in the same direction of its propagation.

Types of waves:

انواع الموجات : طبقا لاتجاه اهتزاز جزيئات الوسط بالنسبة لاتجاه الانتشار (موجة مستعرضة و طولية)

According to direction of vibration of medium particles relative to the direction of propagation:

A : transverse waves.

B: longitudinal waves.

طبقا للقدرة ع الانتشار ونقل الطاقة (موجات ميكانيكية و كهرومغناطيسية)

According to the ability to propagate and transfer energy into:

A : Mechanical waves

B: Electromagnetic waves.

Mechanical and electromagnetic waves:

الميكانيكية : تحتاج وسط (هواء) لانتشارها – لا تنتشر في الفضاء – (موجات مستعرضة وطولية) – السرعة قليلة (الماء-الصوت)
الكهرومغناطيسية (لا تحتاج لوسط – تنتشر في الفضاء – موجات طولية – السرعة عالية (الضوء- الراديو)

Comparison between mechanical and electromagnetic waves:

Mechanical waves	Electromagnetic waves
They need a medium to propagate.	They don't need medium to propagate.
They don't propagate through vacuum	They propagate through vacuum (space).
They are transverse waves or longitudinal waves.	They are all transverse waves.
Their speed is relatively low.	Their speed is great. (3×10^8 m/s)
Examples : <ul style="list-style-type: none"> • water waves (transverse waves) • sound waves (longitudinal waves) 	Examples: <ul style="list-style-type: none"> • Light waves. (speed is 3×10^8 m/s) • Radio waves. (Used in radars.)



Water waves and sound waves are mechanical waves?

Because they need a medium to propagate through.

Light waves and radio waves are electromagnetic waves?

Because they don't need a medium to propagate through.

Transverse and longitudinal waves:

A : Transverse waves:

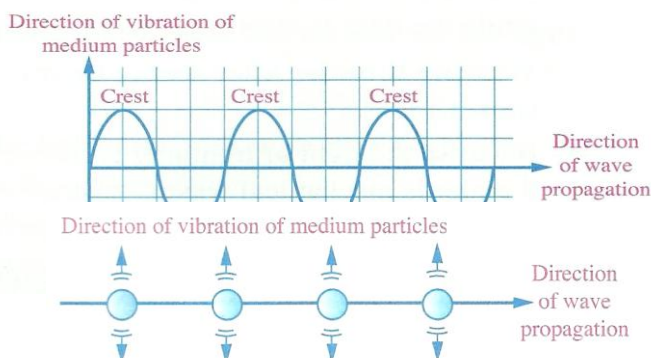
الموجة المستعرضة تتكون من قمة وقاع

Conclusion:

1 - The transverse wave is formed of **crests and troughs**.

2 - The medium particles don't move from their positions, but they vibrate around their rest positions.

3 - The disturbance in which the particles of medium vibrate **perpendicular** to the direction of wave propagation is known as "**transverse wave**"



الموجة المستعرضة : اضطراب تهتز فيه جزيئات الوسط عمودى ع اتجاه انتشار الموجة

Transverse wave:

It is a disturbance in which the particles of the medium vibrate **perpendicular** to the direction of the wave propagation.

القمة : هي أعلى نقطة لجزيئات الوسط للموجة المستعرضة

The crest:

It is the highest point of the particles of the medium in the transverse wave.

القاع : أقل نقطة لجزيئات الوسط للموجة المستعرضة

The trough:

It is the lowest point of the particles of the medium in the transverse wave.



Water waves are transverse waves?

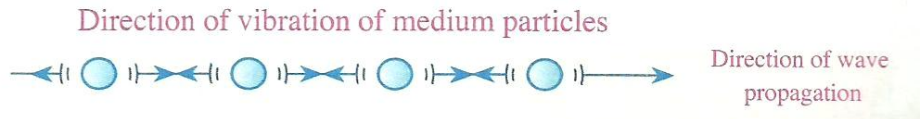
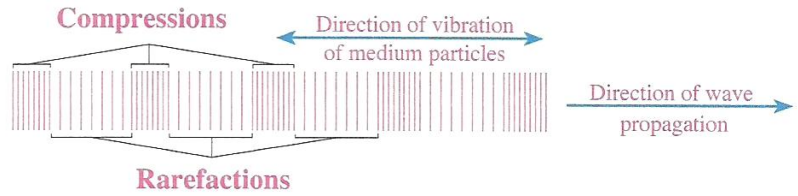
Because the water particles vibrate in a direction perpendicular to the direction of waves propagation.

B : Longitudinal waves

الموجة الطولية : تتكون من تضاغطات وتخلخلات

Conclusion:

- 1 - Longitudinal wave is formed of **compressions and rarefactions**.
- 2 - The medium particles don't move from their rest position but they vibrate around their rest positions.
- 3 - The disturbance in which the particles of the medium vibrate **along** the direction of wave propagation is known as ((longitudinal wave)).



الموجة الطولية : اضطراب تهتز فيه جزيئات الوسط في نفس اتجاه انتشار الموجة

Longitudinal wave:

It is a disturbance in which the particles of the medium vibrate **along** the direction of wave propagations.

التضاغط : جزيئات الوسط في اعلى كثافة وضغط

The compression:

It is the area in the longitudinal wave at which the particles of the medium are of highest density and pressure.

التخلخل : جزيئات الوسط في اقل كثافة وضغط

The rarefaction:

It is the area in the longitudinal wave at which the medium particles are of lowest density and pressure.



Sound waves are longitudinal waves?

Because the medium (air) particles vibrate along the direction of waves propagation.

Comparison between transverse and longitudinal waves:

Points of comparison	Transverse wave	Longitudinal wave
Definition:	It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of wave propagation.	It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.
Composition:	Crests and troughs.	Compressions and rarefactions.
Examples:	Water waves.	Sound waves.

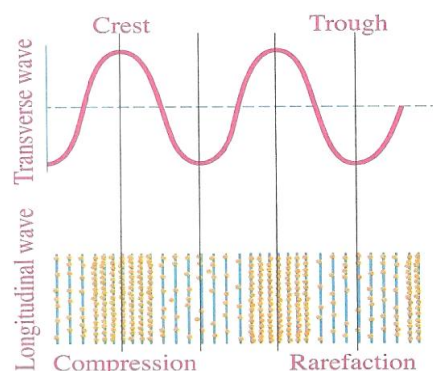
Note

From the opposite figure:

The **crest** in transverse wave is **equivalent to compression** in longitudinal wave:

Similarly, the **trough** is equivalent to the **rarefaction**.

الجاكوزي (انابيب العلاج الطبيعي) : انابيب تتحرك المياه بموجات دائرية
تستخدم في علاج التشنجات العضلية (ماء ساخن) – توتر الاعصاب (بارد)



Real life application: physiotherapy tubes ((Jacuzzi)).

Jacuzzi is a tube where water moves in the form of circular waves.

Uses of Jacuzzi:

Use to treat:

- 1 - **Sprains** and **cramps** by using hot water.
- 2 - **Nervous tension** by using cold water.



Jacuzzi



Wave motion

Some concepts related to wave motion and its properties:

1 - Wavelength.

2 - Amplitude.

3 - Wave velocity.

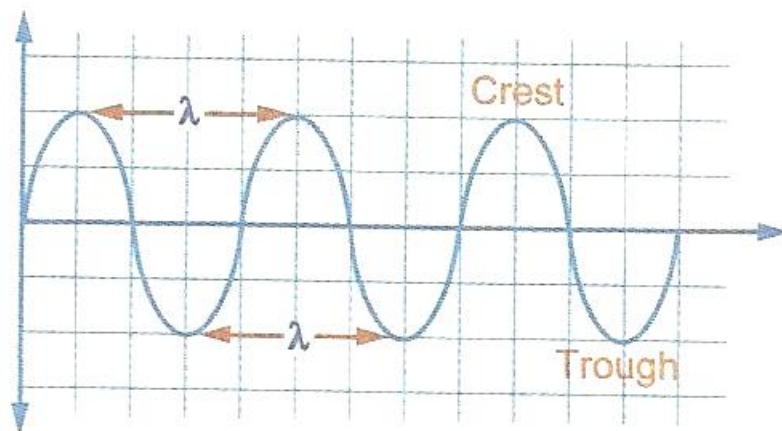
4 - Wave frequency.

الطول الموجي للموجة المستعرضة : المسافة بين اى قمتين – او قاعين – متتاليين

1 - Wavelength λ

The wavelength (λ) of the transverse wave:

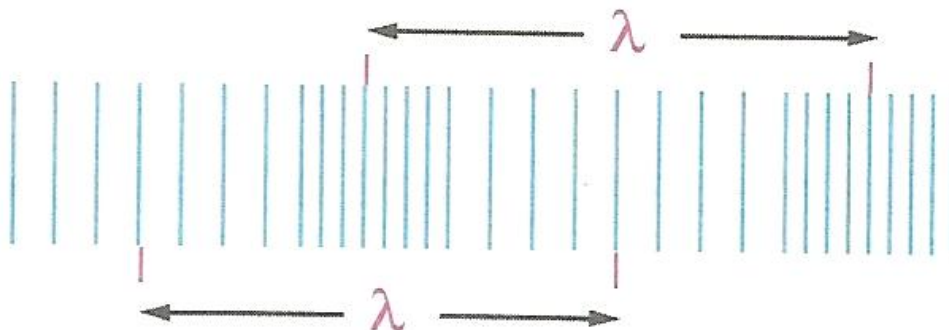
It is the distance between two successive crests or troughs.



الطول الموجي للموجة الطولية : المسافة بين مركزي تضاغطين – او تخلخلين – متتاليين

The wavelength (λ) of the longitudinal wave:

It is the distance between the centers of two successive compressions or rarefactions.



وحدة قياس الطول الموجي : المتر

The measuring unit of wavelength (λ) is "metre"

Note:

- 1 - Millimeter = 1×10^{-3} metre.
- 2 - Micrometer = 1×10^{-6} metre.
- 3 - Nanometer = 1×10^{-9} metre.

What is meant by?



The wavelength of a transverse wave is 10 cm?

This means that the distance between two successive crests or two successive troughs in such wave is 10 cm.



The wavelength of a longitudinal wave is 20 cm?

This means that the distance between the centers of two successive compressions or two successive rarefactions in such wave is 20 cm.

سعة اهتزازة الموجة : اقصى مسافة لجزيئات الوسط بعيدا عن موضع السكون (الوحدة : المتر – سم)

2 - Amplitude

The amplitude of the wave:

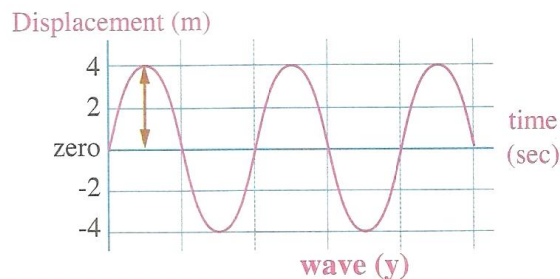
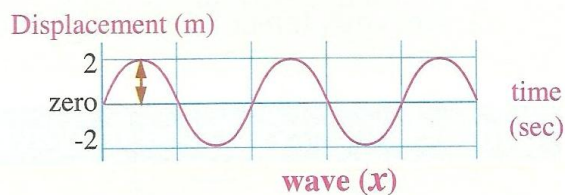
It is the maximum displacement achieved by the medium particles away from their rest positions.

The measuring unit of amplitude is "metre" or "centimeter"



Exercise:

Compare between the amplitudes of both waves (X) and (Y) shown in the figure?



Answer:

amplitude of wave (y) is larger than that of wave (x).

Amplitude of wave (y) = 4 m

Amplitude of wave (x) = 2 m

3 - The Wave velocity (V).

سرعة الموجة : هي المسافة التي تقطعها الموجة في الثانية (م/ث)

Wave velocity (V):

It is the distance covered by the wave in one second.

The measuring unit of wave velocity is metre per second (m/s).

Water velocity can be determined by the relation:

Wave velocity (V) = distance covered by the wave in metres (m) / time in seconds.

سرعة الصوت في المواد الصلبة اكبر من السائلة التي تكون اكبر من الغازية

- the velocity of sound waves through air = 340 m/s
- the velocity of sound waves through water = 1500 m/s
- the velocity of sound waves through wood = 1850 m/s

So, the velocity of sound through gases (air) is smaller than that through liquids.

The velocity of sound through liquids is smaller than that through solids.

4 - Wave frequency (F)

تردد الموجة : هو عدد الموجات في الثانية الواحدة (الهرتز)

Wave frequency:

It is the number of waves produced from the source in one second.

The measuring unit of frequency is Hertz.

Wave frequency can be determined by the relation:

Wave frequency = number of produced waves / time in seconds (s)

Periodic time of the wave (T) = 1 / frequency (F)

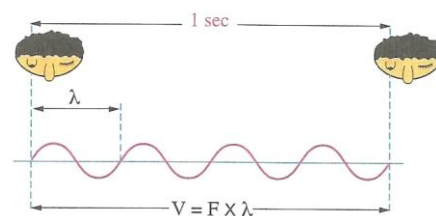
الزمن الدوري : الزمن اللازم لعمل موجة واحدة

The periodic time of the wave is the time needed to make one wave.

قانون انتشار الموجة : هو العلاقة بين سرعة الموجة - التردد - الطول الموجي في الحركة الموجية

Law of wave propagation:

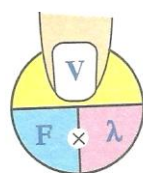
It is the relation between the wave velocity (V), its frequency (F) and wavelength (λ) in the wave motion.



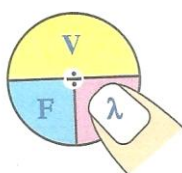
Therefore :

$$\text{Wave velocity (V)} = \text{frequency (F)} \times \text{Wavelength (\lambda)}$$

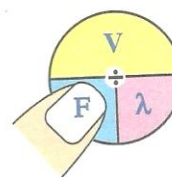
Note: this relationship is applied for all kinds of waves.



To find the wave velocity

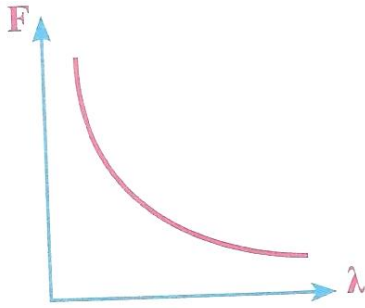


To find the wavelength

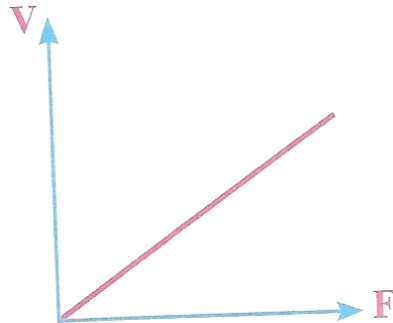


To find the frequency

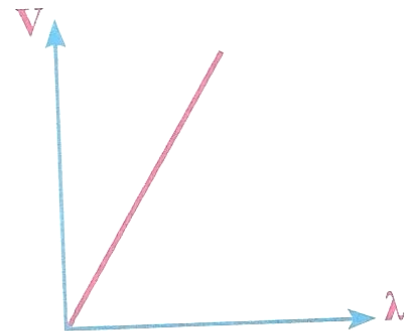
Notice that:



Frequency (F) is inversely proportional to wavelength in the same medium



wave velocity is directly proportional to frequency at constant wavelength



Wave velocity V is directly proportional to wavelength at constant frequency F



Exercise:

Calculate the wavelength in metre for a visible light wave of frequency 5×10^{14} Hertz, and velocity of 3×10^8 m/s.

Answer:

$$\begin{aligned} \text{Wavelength } (\lambda) &= \text{wave velocity (V) / frequency (F)} \\ &= 3 \times 10^8 / 5 \times 10^{14} \\ &= 0.6 \times 10^{-6} = 6000 \times 10^{-10} \text{ metre.} \end{aligned}$$



Problem

A longitudinal wave is produced by a spiral spring such that the distance between the first and the fourth rarefactions is 18 cm.

Find the wave velocity if the frequency of such wave is 20 Hertz.

Solution:

3 waves are formed between the first and fourth rarefactions.

Then wavelength (λ) = $18 / 3 = 6 \text{ cm} = 0.06 \text{ m}$.

Then: wave velocity (V) = wavelength (λ) \times wave frequency (F) = $0.06 \times 20 = 1.2 \text{ m/sec}$.

Comparison between oscillatory (vibrational) motion and wave motion:

Points	Oscillatory motion	Wave motion
Definition:	It is the motion of the oscillating body around its rest point, where the motion is repeated through equal intervals of time.	It is the motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction.
Amplitude:	The maximum displacement of the oscillating body away from its rest position.	The maximum displacement achieved by the medium particles away from their rest positions.
Frequency:	The number of complete vibrations made by the vibrating body in one second.	The number of waves produced by the wave source in one second.
Periodic time:	It is the time of one complete vibration.	It is the time of one wave.
Velocity:	The velocity is maximum when the oscillating body passes its rest position and decreases gradually when it goes far from its rest position.	The velocity is constant through the same medium, but it changes from one medium to another.
Examples:	<ul style="list-style-type: none"> - pendulum's motion. - motion of spiral spring. 	<ul style="list-style-type: none"> - sound waves as mechanical longitudinal waves. - Light waves as electromagnetic transverse waves.

Lesson 1: Properties of sound waves

خواص موجات الصوت – الصوت : مؤثر خارجي يؤثر ع الاذن بسبب الاحساس بالسمع

Sound: Is an external factor (stimulus) that affects the ear causing sense of hearing.

الصوت ينتج نتيجة اهتزاز الاجسام ويتوقف عند توقف الاهتزاز – موجات ميكانيكية طولية تحتاج لوسط مادي للانتشار

* **Sound** is produced due to the vibration of bodies & stops when the vibration stops.

* **Sound waves** are mechanical longitudinal waves, which need a medium to propagate.

موجات الصوت تتكون من تضاعطات وتخلخلات – تنتشر ع هيئة كرات مركزها مصدر الصوت

* **Sound waves** consist of compressions & rarefactions.

* **Sound waves** propagate through media as spheres whose centre is the sound source.

نسمع الصوت من جميع الاتجاهات – لانه ينتشر ع هيئة نبضات من التضاعطات والتخلخلات

We hear sound from all directions that surround the sound source.

Because sound travels through air as pulses of compressions & rarefaction.

الطول الموجي لموجات الصوت (طولية) هي المسافة بين مركزى تضاعطين متتابعين – او تخلخلين متتابعين

What is meant by the wavelength of a sound wave is 1.5 m.

The distance between the centers of two successive compressions or two successive rarefactions is 1.5 m.

سرعة الصوت : هي المسافة التي يقطعها الصوت فى الثانية الواحدة

Sound velocity: Is the distance covered by sound waves in one second

* Sound waves propagate through different media with different velocities.

N.B. لاحظ

سرعة الصوت فى المواد الصلبة اكبر من السائلة التى تكون اكبر من الغازية

* **Sound velocity** through gases (air) is 340 m/sec.

* **Sound velocity** through liquids is larger than through gases.

* **Sound velocity** through solids is larger than through liquids

Properties of sound waves: خواص موجات الصوت – الاصوات تنقسم الى نوعين

Sounds can be classified into two groups which are:

نغمات موسيقية : هي نغمات لها تردد منتظم مريح للسمع (الالات الموسيقية)

1-Musical tones:

They are tones of **uniform frequency** and comfortable to be heard.

e.g. (Violin, piano and reed pipe).

الضوضاء : صوت ذات تردد غير منتظم – غير مريح للسمع (الحفار – مكبرات الصوت – ابواق السيارة)

2-Noise: Is sound of non-uniform frequency & uncomfortable to be heard.

e.g. (Drill, loudspeakers and car horns).

الاذن تستطيع تمييز الاصوات عن طريق 3 عوامل مختلفة : درجة الصوت – شدة الصوت – نوع الصوت

Human ear can differentiate between sounds that reach it through three different factors which are:

درجة الصوت : خاصية تستطيع الاذن ان تميز بين الصوت الغليظ والرفيع

1-Sound pitch: Is a property by which the ear can distinguish between rough (harsh) and sharp voices.

صوت المرأة درجته عالية (اعلى تردد) – صوت الرجل درجته منخفضة (اقل تردد)

* High pitched sound is sharp (soft). * Low pitched sound is rough (harsh)

* Voice of women is high pitched as it is sharp

* Voice of men is low pitched as it is rough.

الصوت يصبح غليظ عندما يزداد طول الخيط (وتر الآلة الموسيقية) – ويكون رفيع عندما يقل طول الخيط

Sound becomes more harsher as the length of the string increases

And becomes more sharper as the length of the string decreases.

درجة الصوت تعتمد ع التردد – اى تزداد بزيادة التردد – وتقل درجة الصوت عندما يقل التردد

The sound pitch depends on frequency.

The sound pitch increases by increasing the frequency and vice versa.

اى ان الصوت الرفيع ذات تردد عالى – الغليظ ذات تردد منخفض

Therefore: The **sharp** tones have **high frequency**, while the **harsh** (or rough) tones have **low frequency**.

التردد يزداد عندما يقل طول عمود الهواء (عند النفخ فى زجاجات مختلفة)

Note: the frequency increases by decreasing the length of air column and vice versa.

تعيين درجة صوت النغمات باستخدام عجلة سفارى – تستخدم عجلة سفارى فى تعيين درجة (تردد) نغمة مجهولة

Steps for determining the pitch of a tone using Savart's wheel:

Savart's wheel is used to determine the pitch (frequency) of an unknown tone.

Sound frequency (F) = number of cycles (d) × number of gear's teeth (n) / time (t)

Note speed of rotation = number of rotations (turns) / time (t)

بزيادة سرعة الدوران يزداد التردد ويصبح درجة الصوت رفيع (حاد)

So that, by **increasing the speed of rotation**, the **frequency increases** and the sound becomes high-pitched (sharp).

شدة الصوت : خاصية تميز بها الاذن بين الصوت الضعيف والقوى

2-Sound intensity: Is the property by which the ear can distinguish (differentiate) between weak or strong sounds.

Examples:

الطبلية تصدر صوت قوى عند ضربها بقوة – وصوت ضعيف عند ضربها برفق

a) A drum produces a strong sound when it is beaten strongly and it produces weak sound when it is beaten softly.

المدفع صوته اقوى من البندقية

b) A cannon makes a stronger sound than a rifle.

شدة الصوت تقاس ب كمية طاقة الصوت العمودية ع وحدة المساحة فى الثانية

* The **intensity of sound** at a certain point is **measured by** the quantity of sound energy falling perpendicularly in one second on a unit area at this point.

عندما تكون طاقة الصوت مرتفعة تعطى صوت قوى – وعندما تكون منخفضة تعطى صوت ضعيف

* If the sound energy is high, it gives strong sound, but if it is low, it gives weak sound.

وحدة قياس شدة الصوت (الوات/م²) – وحدة قياس الضوضاء (الديسيبل)

N.B.

* The **measuring unit** of **sound intensity** is **watt/m²**

* The **noise intensity** is **measured** in a **unit** known as “**Decibel**”.

العوامل المؤثرة ع شدة الصوت – المسافة بين الأذن ومصدر الصوت – سعة الاهتزازة – مساحة السطح المهتز – كثافة الوسط التي تنتشر فيه – اتجاه الرياح

Factors affecting the sound intensity:

- 1- Distance between the ear & the sound source.
- 2- Amplitude of vibration of the sound source.
- 3- Area of the vibrating surface.
- 4- Density of the medium through which the sound travels (propagates).
- 5- Wind direction.

1- Distance between the ear and the sound source:

شدة الصوت تضعف عند البعد عن مصدر الصوت – أى بزيادة المسافة تضعف شدة الصوت
لأن شدة الصوت تتناسب عكسيا مع مربع المسافة ويسمى قانون التربيع العكسى للصوت

The intensity of sound becomes fainter gradually as you move farther away from the sound source.

Because the intensity of sound (I) at a point is inversely proportional to the square of distance (d^2) and this is known as” The inverse square law of sound”

Inverse square law of sound:

The intensity of sound at a point varies inversely with square of distance between this point & sound source.

G.R Sound intensity increases 4 times when distance decrease to half

Bec. Sound intensity inversely prop. with **square** distance between the ear and sound source

شدة الصوت تقل عندما تقل سعة الاهتزازة (اهتزاز اوتار) – أى تناسب طردي

2-Amplitude of vibration of the sound source:

* Sound intensity decreases gradually by decreasing amplitude of vibration.

* Sound intensity is directly proportional to the square of amplitude of the vibration of the sound source.

بزيادة سعة الاهتزازة مرتين – شدة الصوت تزيد 4 مرات - (مربع سعة الاهتزازة)

* When the amplitude increases two times, the intensity of sound increases four times.

صوت الموبيل المثبت ع صندوق رنان اقوى – شدة الصوت تزيد لزيادة مساحة السطح المهتز

3- Area of the vibrating surface:

* The sound produced from the phone which is fixed on the resonance box is stronger than that is produced from the phone which is held.

G.R Sound intensity increases when the sound source touches a resonance box.

Due to the increase of the surface area of the vibrating body.

G.R Stringed musical instruments (guitar & violin) are fixed above a wooden box.

To increase the sound intensity by increase area of the vibrating body

شدة الصوت تتناسب طرديا مع كثافة الوسط

4- Medium density:

* Sound intensity is **directly proportional** to the medium density.

G.R Sound intensity in carbon dioxide gas as a medium is higher than in air.

Because the density of carbon dioxide gas is more than air.

شدة الصوت تزداد عند انتشاره في نفس اتجاه الرياح – وتقل في عكس اتجاه الرياح

5- Wind direction:

* The intensity of sound increases when the sound waves propagation direction is in the same direction of wind.

* The intensity of sound decreases when the sound waves propagation direction is in the opposite direction of wind.

سدادات الأذن : تستخدم لتجنب خطر الضوضاء في الأماكن الصاخبة

Real life application (Ear Plugs):

* **Ear plugs are used.**

To avoid hazards of noise in loud places.

نوع الصوت : خاصية تميز بها الأذن بين الأصوات المختلفة حتى لو متساوية في الشدة والدرجة لأنها تصاحبها نغمات توافقية

3- Sound type (quality):

It is the property by which the human ear can distinguish between different sounds even if they are equal in intensity & pitch.

النغمات التوافقية : نغمات تصاحب النغمة الأساسية أقل في الشدة وأعلى في الدرجة

Harmonic tones:

They are tones that accompany the fundamental (basic) tone, but they are lower in intensity & higher in pitch .

G.R Human ear distinguishes between sounds from different sources even if they are equal in intensity and pitch.

Due to the harmonic tones that accompany the basic tone of the sound source and are lower in intensity and higher in pitch.

انواع موجات الصوت : موجات سمعية – موجات غير سمعية

Types of Sound Waves:

الموجات السمعية : ترددها من 20 هرتز الى 20 ألف هرتز (20 كيلو هرتز)

1- Audible sounds (Sonic waves) They are sound waves of frequencies ranging from 20 to 20000 Hz (20 KHz)

الأذن تسمع الموجات السمعية فقط – لأن الأذن تنقل هذه الموجات إلى المخ الذي يترجمها إلى أصوات مسموعة

G.R Human ear can hear sounds of frequencies ranging from 20 to 20000 Hz.

Because the ear transmits the effect of these waves to the brain which translates them into sounds & audible tones.

الاصوات الغير مسموعة : تنقسم لنوعين الموجات تحت السمعية – فوق السمعية

2- Non-audible sounds:

الموجات تحت السمعية : ترددها اقل من 20 هرتز – تصاحب هبوب العواصف – لا يسمعها الانسان

a) **Infrasonic waves:** They are sound waves of frequencies less than 20Hz

* **These waves accompany blowing of storms.**

* The human ear cannot hear infrasonic waves

الموجات فوق السمعية : ترددها اكبر من 20 الف هرتز – تميزها الحيوانات – لا يسمعها الانسان

b) **Ultrasonic waves:** They are sound waves of frequencies more than 20000 Hz (20KHZ)

* Some animals such as bats, dogs and dolphins can hear ultrasonic waves.

* The human ear cannot hear ultrasonic waves

G.R Dogs can hear all sounds produced by man.

Because man produces sounds of frequencies less than 20 kilohertz and dogs can hear sounds up to 50 kilohertz.

G.R Man can't hear sounds produced by dolphins.

Because dolphins produce sounds up to 120 kilohertz, while man can hear sounds of frequencies up to 20 kilohertz only.

استخدامات الموجات فوق السمعية

Some real life applications of ultrasonic waves:

The field in which the ultrasonic waves are used	The uses
1-Medical field: مجال الطب : تفتيت الحصوات – تشخيص اورام البروستاتا – اكتشاف الاورام الخبيثة	1- Breaking down kidney & ureter's stones 2- Diagnosis of male prostate tumors 3- Discovering malignant tumors.
2-Industrial field: في الصناعة : تعقيم الغذاء والماء واللبن – لانها تقتل البكتريا وتوقف عمل الفيروسات	<u>Sterilization of food, water and milk.</u> Because it kills some types of bacteria and stop the action of some viruses.
3-Military field: المجال العسكرى : اكتشاف الالغام	Discovering of landmines.



Reflection of sound waves



انعكاس الصوت : ارتداد موجات الصوت في نفس الاتجاه عند اصطدامها بسطح عاكس

Sound reflection:

It is the return of sound waves in the same direction due to hitting a reflecting surface.

Laws of reflection of sound

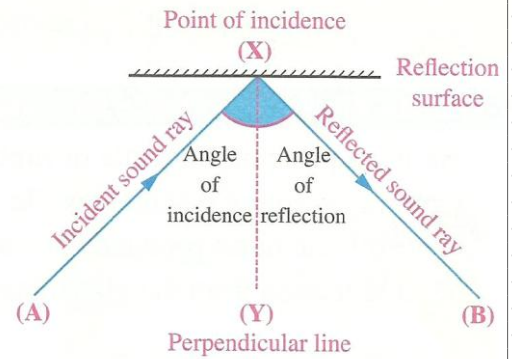
قانونا انعكاس الصوت – القانون الاول : زاوية السقوط = زاوية الانعكاس

The two laws of sound reflections"

First law

The angle of incidence = the angle of reflection.

القانون الثانى : الشعاع الساقط والمنعكس والخط العمودى يكونوا فى مستوى واحد عمودى ع السطح العاكس



Second law:

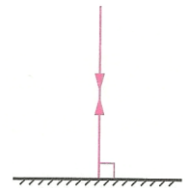
The incident sound ray , the reflected sound ray and the perpendicular line from the point of incidence on the reflecting surface, all lie on the same plane, perpendicular to the reflecting surface.

الشعاع الساقط عمودى ع السطح العاكس – ينعكس ع نفسه – لان زاوية السقوط = زاوية الانعكاس

G.R: When sound ray is incident perpendicular to a reflecting surface.

It reflects on itself?

Because the angle of incidence = the angle of reflection = zero.



Example:

Calculate the angle of reflection if the angle between the incident sound ray and the reflected sound ray is 30°

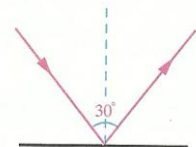
Answer:

Angle of reflection = $30 / 2 = 15^\circ$

توضع قطعة موكيت تحت الغسالة – لامتصاص الاهتزازات

G.R : A piece of moquette is put under the washing machine?

To absorb the noise produced due to vibration instead of its reflection from the glistening surfaces of walls.



مفاهيم مرتبطة ب انعكاس الصوت

Concepts related to sound reflection

الشعاع الصوتي : خط يوضح اتجاه انتشار موجة الصوت

Sound ray :

It is the direction of the line of propagation of sound wave.

زاوية السقوط : الزاوية المحصورة بين الشعاع الساقط والعمود المقام

Angle of incidence of sound ray:

It is the angle between the incident sound ray and the line perpendicular to the reflecting surface at the point of incidence.

زاوية الانعكاس : الزاوية المحصورة بين الشعاع المنعكس والعمود المقام

Angle of reflection of sound ray.

It is the angle between the reflected sound ray and the line perpendicular to the reflecting surface at the point of incidence.

صدى الصوت : هو تكرار الصوت نتيجة لانعكاسه

Echo

Echo :

It is a repetition of sound produced due to its reflection.

شروط حدوث صدى الصوت : وجود سطح عاكس كبير (الجبل) -

The conditions necessary for hearing the echo:

- 1 - Presence of wide and big reflecting surface such mountains.
المسافة لا تقل عن 17 متر - الوقت لا يقل عن 10/1 من الثانية
- 2 - The distance between sound source and reflecting surface must not less than 17 meters, where the time to hearing echo should not less than 0.1 second.

لان اذن الانسان لا تستطيع التمييز بين صوتين الوقت بينهما اقل من 10/1 ث

Therefore : the human ear can not distinguish between two successive sounds if the period between them is less than 0.1 second.

G.R:: Echo cannot be heard if the distance between the sound source and the reflecting surface is less than 17 meters?

Because the time between hearing the main sound and its echo will be less than 1/10 of a second ,so human ear can not distinguish between the two successive sounds.

Real life application of echo (sound reflection)

- 1 - Determination of sound speed (velocity) through air. قياس سرعة الصوت فى الهواء
- 2 - Concentration of sound. تركيز الصوت (المساجد)
- 3 - Determination of sea depth and fish shoals. قياس عمق البحر وتجمعات الاسماك
- 4 - Detecting industrials defects. كشف عيوب الصناعة
- 5 - Medical diagnosis. التشخيص الطبى (السونار)
- 6 - Locating the position of surfaces and barriers. تحديد اماكن الاسطح والحواجز (الخفاش)

سرعة الصوت فى الهواء = المسافة بالمتري $\times 2$ / الوقت بالثانية

1 - Determination of sound speed through air.

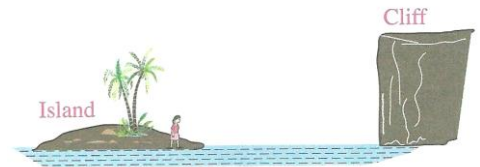
You can calculate the velocity of sound through air using the relation:

Velocity of sound (V) = twice the distance between source of sound and the reflecting surface (2d) / the average time of echo in seconds (t).

$$V = 2d \text{ (meters)} / t \text{ (sec)} = \dots\dots\dots \text{ m/sec.}$$

Problems:

A girl stood at the shore of an island and produced a sound, its echo was heard after 3 seconds, Calculate the distance between the shore and the cliff given that the velocity of sound through air in this region is 330 m/s.

**Solution:**

As $V = 2d / t$

Then $d = t V / 2 = 3 \times 330 / 2 = 495 \text{ meters.}$

عند سقوط الصوت ع سطح مقعر (القبة) فإنه يتجمع في البؤرة
ليكون الصوت اكثر وضوحا وتزيد شدة الصوت

2 - Concentration of sound.

- when sound waves fall on a **concave surface** ,
the reflected sound waves will be collected at a
point known as **focus**

- To make sound more clear and to increase its intensity.

تركيز الصوت : هو تجمع الصوت في نقطة نتيجة لانعكاسه ع سطح مقعر

Concentration of sound:

It is the conversion (collection) of sound at a point due to its reflection on a concave surface.

هذه الظاهرة تستخدم عند بناء دور العبادة وقاعة المؤتمرات

This phenomenon is applied when building **worship places** and **big conference halls**.

These places are supplied by **concave walls** and ceilings to
concentrate the reflected sound and make the sound more clear
and more intense.

علماء المسلمين استخدم تركيز الصوت لتقوية صوت الخطيب في المسجد



The dome of worship

Note :

In the past , Moslem scientists used the property of sound reflection to concentrate
and enforce the voice of Imam to all parts of the mosque.

G.R: The voice of Imam can be heard clearly in all parts of large mosques without using
microphones?

Because the surface of large mosques are concave which concentrate the reflected sound
waves and make the sound clearer and more intense.

G.R : Fennec fox has large ability of hearing?

Because it has large and concave ear pinna that concentrates the reflected sound and make it
more clear and more intense.



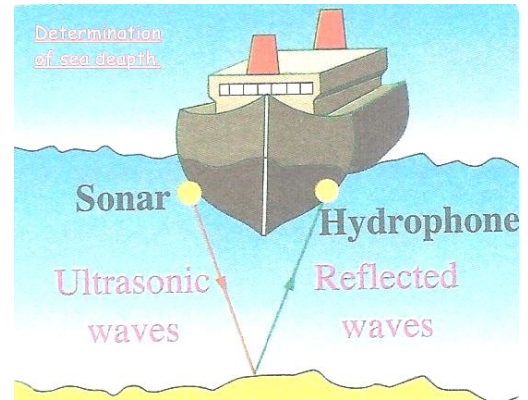
Fennec fox

3 - Determination of sea depth and fish

Ultrasonic waves of frequencies higher than 20000 Hz are used for:

- estimating the depth of seas
- exploring the fish gathering (shoals) in seas.

يُثبت في السفينة جهاز السونار : لينتج الموجات فوق السمعية
الهيدروفون : يستقبل الموجات المنعكسة من قاع البحر



How to determine the sea depth?!!

a. Two devices are fixed at the bottom of the ship.

- 1 - Sonar device which produce ultrasonic waves.
- 2 - A hydrophone set which receives the reflected waves from seabed (fish shoals).

المسافة (المتر) = السرعة × الوقت / 2

If the velocity of ultrasonic waves through water is (V) m/sec., so the depth of sea or location of fish shoals can be determined by the relation:

Depth (d) = velocity of ultrasonic waves (V) × echo time (t) / 2

Then $d(m) = t V / 2$

Problem:

A sailor produced a sound in the sea, he heard its echo after 0.6 second, if the velocity of sound through water is 1435 m/sec, calculate the depth of sea.

Solution:

$$d = tV / 2 = 0.6 \times 1435 / 2 = 430.5 \text{ m.}$$

4 - Detecting industrial defects:

عيوب الصناعة يمكن كشفها عن طريق اختلاف شدة الموجات المنعكسة (عيوب هواء أو لحام)

- Defects in manufactures can be detected through the **variation in the intensity of the reflected waves**.

G.R : The ultrasonic waves can be used in detecting the industrial defects?

Because the waves reflected from areas which have defects have a different intensity than those reflected from well welded areas. موجات منعكسة مختلفة عن السليمة

5 - Medical diagnosis

الموجات فوق السمعية تستخدم في تحديد نوع الجنين وحالته الصحية بانعكاس الموجات الصوت

- Ultrasonic waves are used in detecting the sex of embryo and his health state.

This process depends on the ability of different parts of body -
to reflect ultrasonic waves.



Medical diagnosis

الخفاش يستطيع معرفة اماكن الفريسة - يطير في الظلام دون اصطدام بالاشياء- عن طريق اطلاق موجات فوق سمعية واستقبالها بعد انعكاسها - الدولفين يستخدم نفس الخاصية

6 - Locating the position of surfaces and barriers الحواجز

* Bats can use the phenomenon of sound reflection (echo) in their daily life to :

- 1 - Locate the position of their preys.
- 2 - Fly in the dark without colliding with anything.

This is achieved by transmitting ultrasonic waves and receiving them after reflection.



A dolphin under water

Similarly : dolphins can avoid obstacles on their way under water.

G.R: Bats can fly in the dark without colliding with anything?

Because they produce ultrasonic waves that reflect on the surfaces and barriers then receive them back and locate their positions.



A bat catches an insect



Wave Nature of light



الضوء : مؤثر خارجي يؤثر ع العين يسبب الاحساس بالرؤية

Light

It is an external factor which affects the eye causing the sense of vision.

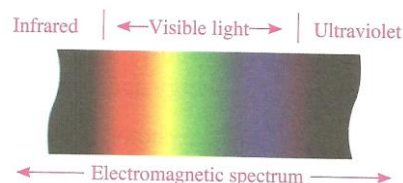
طبيعة موجات الضوء : موجات كهرومغناطيسية تنتشر في الفضاء بسرعة كبيرة

Nature of light waves

- Light waves are electromagnetic waves which can travel through free space with velocity 300 000 km/sec. (3×10^8 m/sec)

تتكون من قمم وقيعان (مستعرضة)

- Light waves are formed of crests and troughs.
سرعة الضوء : المسافة التي يقطعها الضوء في ثانية واحدة



Speed of light

It is the distance covered by light in one second.

الضوء المرئي : من مكونات الطيف الكهرومغناطيسي له طول موجي

The visible light:

It is one of the components of electromagnetic spectrum of wavelength ranges between 380 : 700 nanometers.

تحليل الضوء : تفكك الضوء الابيض الى الوان الطيف (الشمس مصدر الضوء ع الارض)

Analysis (or splitting) of white light

The sun is the main source of light energy on the earth's surface.

Analysis of white light

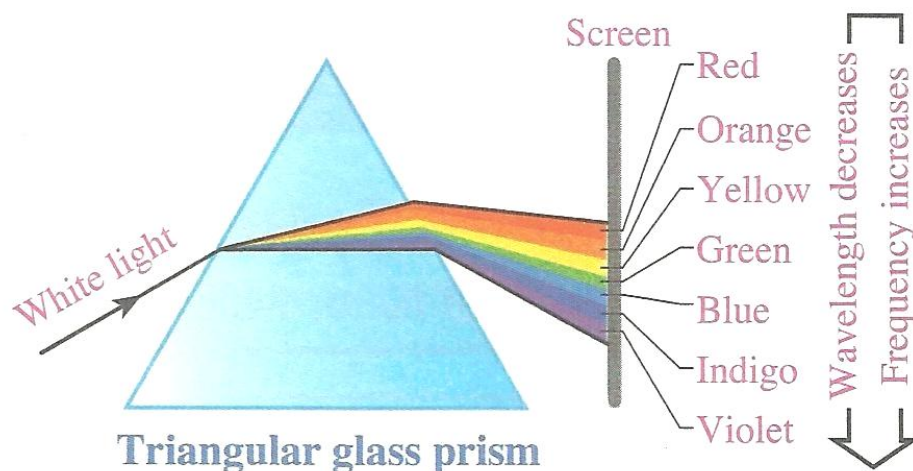
It is the splitting of white light into seven colors called spectrum colors.

** If you put a compact disc (CD) on a table faces sun rays, you will observe the formation of seven colors,
This due to the analysis of white light into seven colors.

** White light consists of a mixture of seven colors which are known as (spectrum colors).



Compact discs



These colors are: Red >>> Orange >>> yellow >>> Green >>> Blue >>> Indigo >>> Violet.

**** Similarly, when the white falls on a triangular glass prism, it analyses into seven spectrum colors, as in figure.**

اللون الاحمر : اقل انحرافا (قريب من رأس المنشور) - اقل تردد - اكبر طول موجي (علاقة عكسية بين التردد والطول الموجي)

Red >>> it is the lowest deviation (close to the prism apex)

It is the lowest frequency

It is the longest wavelength.

اللون البنفسجي : اعلى انحرافا (قريب من قاعدة المنشور) - اعلى تردد - اقل طول موجي (علاقة عكسية بين التردد والطول الموجي)

Violet >>> it is the highest deviation. (close to the prism base)

It is the highest frequency

It is the shortest wavelength.

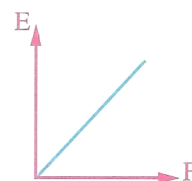
العالم الالماني ماكس بلانك اثبت ان طاقة الضوء تتكون من كمات (كميات) تسمى الفوتونات

Energy of light wave

The German scientist **Max Planck** proved in 1900 that the energy of light waves is composed of energy **quanta** known as (**Photons**).

طاقة الفوتون تتناسب طرديا مع التردد

- The energy of photon (E) is **directly** proportional to the **frequency** of the light wave (F).



Photon energy \propto photon frequency

Photon energy = constant \times photon frequency.

**** The constant value is known as Planck's constant.**

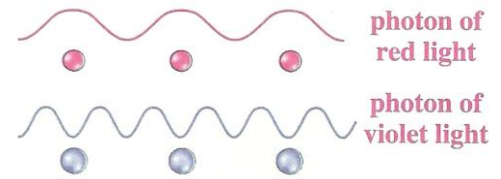
Photon energy = Planck's constant \times photon frequency.

Exercise:

Which one has a greater energy, the photon of red light or the photon of violet light?

Given that the frequency of red light is less than that of violet light.

طاقة اللون الاحمر اقل من البنفسجي لانه يتناسب طردي مع التردد



Answer:

The energy of photon of red light is smaller than that of photon of violet light, because the energy of photon is directly proportional to the frequency.

Real life application for uses of light:

استخدام الضوء في : اضاءة اللوحات الفنية – مصابيح الزينة - الاباجورات

Light is used in home decoration like:

- * Spot lights to illuminate artifacts.
- * ornamented lamps that bring happiness and joy to the place.
- * stand lamps that concentrate light for reading.



Spot light



Stand lamp

Light behavior through different media

- Light transmits through different media with variable degrees.

انتقال الضوء في الوسط الشفاف – النصف شفاف – المعتم

Classification of media

A: Transparent medium

الوسط الشفاف الذي يسمح بمرور كل الضوء خلاله – نرى الاجسام بوضوح من خلاله – الزجاج هواء ماء

Transparent medium:

It is the medium which permits most light to pass through..

- ** Objects can be seen clearly through transparent medium.

Examples:

- Clear glass, air, pure water , a glass cup.

بزيادة سمك الوسط الشفاف كمية الضوء التي تمر خلاله تقل – لذلك لا نرى الاسماك في قاع نهر النيل

Note

By increasing the thickness of the transparent medium, the quantity of light that passes through it decreases.



G.R Although water is a transparent medium we can not see fish at the bottom of the river Nile?

Because the thickness of water at that point (bottom) is large enough to prevent light to pass through.

الوسط النصف شفاف الذي يسمح بمرور جزء من الضوء خلاله - نرى الاجسام اقل وضوحا من خلاله - الزجاج الملون - المناديل الورقية

B: translucent medium

Translucent medium

It is the medium which permits only a part of light to pass through and absorbs the remaining part.

Objects can be seen through translucent medium less clearly than the transparent one.

Examples;

Flint glass - tissue paper.

الوسط المعتم الذي لا يسمح بمرور الضوء خلاله - لا نرى الاجسام من خلاله - اوراق النبات - الجلد - العسل الاسود

C: Opaque medium

Opaque medium

It is the medium that doesn't permit light to pass through..

**** objects can't be seen through opaque medium.**

Examples:

Plant leaves, foil paper, milk, books, metals, wood, cartoon, human skin, black honey.

G.R Cartoon is an opaque medium?

Because it doesn't permit light to pass through and objects can't be seen behind it.

Exercise:

Compare between transparent, translucent and opaque media?

Points	Transparent m.	Translucent m.	Opaque m.
Definition			
Examples			

الضوء يسير فى خطوط مستقيمة يمكن التحكم فى سمكه

Light travels in straight lines:

Light propagates (travels) through transparent media in straight lines whose thickness can be controlled.



Light travels in straight lines

شدة الضوء (السطوع)

Light intensity (brightness)

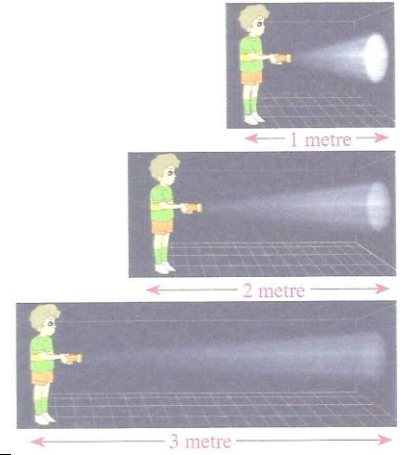


Activity >>> to illustrate the concept of light intensity.

عند زيادة المسافة (البعد) بين الحائط ومصدر الضوء – كمية الضوء تقل

As the distance between the wall and the light source increases, the quantity of light incident on the unit area of the surface decreases.

شدة الضوء : كمية الضوء الساقطة عموديا ع وحدة المساحة فى الثانية الواحدة



Light intensity:

It is the quantity of light falling perpendicular to a unit area of a surface in one second.

تقل شدة الضوء كلما زادت المسافة بين السطح ومصدر الضوء

- Light intensity of a surface decreases as the distance between the surface and the light source increases.

قانون التربيع العكسى للضوء : شدة الضوء تتناسب عكسى مع مربع المسافة

The inverse square law of light:

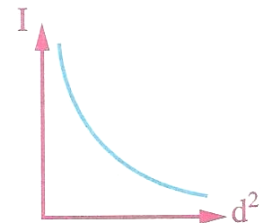
The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.

شدة الاضاءة تزيد 4 مرات عندما تقل المسافة للنصف



G.R The intensity of light increases four times when the distance between the light source and you decrease to its half value?

Because the light intensity is inversely proportional to the square of the distance between them.



Lesson 4: Reflection & Refraction of Light

انعكاس الضوء : ارتداد موجات الضوء في نفس الوسط عندما يسقط ع سطح عاكس

Light reflection: Is the rebounding (returning back) of light waves in the same medium on meeting a reflecting surface.

انعكاس الضوء ينقسم طبقا لنوع السطح العاكس الى : انعكاس منتظم – غير منتظم

Light reflection is classified according to natural of reflecting surface into:

الانعكاس المنتظم : هو انعكاس الضوء ع سطح عاكس ناعم لامع في اتجاه واحد (المرآة – الألومنيوم – الاستنسل)

1- Regular reflection: It is light reflection when it falls on a smooth and glistening reflecting surface in one direction.

Ex. (Plane mirror - sheet of aluminum & Stainless steel).

الانعكاس الغير منتظم : هو انعكاس الضوء ع سطح خشن في اتجاهات مختلفة (الورق – الجلود – الصوف)

2- Irregular reflection: It is light reflection when it falls on a rough reflecting surface in different directions.

Ex. (Leaf of a tree - paper - leather - wool).

الشعاع الضوئي الساقط : شعاع ضيق يمثل بخط مستقيم يتقاطع مع السطح العاكس

Incident light ray: It is a narrow beam, which is represented by a straight line, it intersects with the reflecting surface.

الشعاع الضوئي المنعكس : شعاع ضيق يمثل بخط مستقيم يرتد من السطح العاكس

Reflected light ray: It is a narrow light beam, which is represented by a straight line that is reflected from the reflecting surface.

زاوية السقوط : الزاوية بين الشعاع الساقط والعمود المقام

Angle of incidence: It is the angle between the incident light ray & the line perpendicular to the reflecting surface.

زاوية الانعكاس : الزاوية بين الشعاع المنعكس والعمود المقام

Angle of reflection: It is the angle between the reflected light ray & the line perpendicular to the reflecting surface.

قانون الانعكاس

Laws of light reflection:

زاوية السقوط = زاوية الانعكاس

First law: Angle of incidence = Angle of reflection

الشعاع الساقط والمنعكس والعمود في مستوى واحد عمودي ع السطح العاكس

Second law: The incident light ray, reflected light ray & the normal line, all lie in one plane perpendicular to the reflecting surface.

الشعاع الساقط عموديا ع السطح العاكس – ينعكس ع نفسه – لان زاوية السقوط = زاوية الانعكاس = صفر

The incident light ray which falls perpendicular on a reflecting surface, reflects on itself.

Because angle of incidence = angle of reflection = zero.

تطبيقات ع انعكاس الضوء

Technological application of light reflection:

منظار الافق : في الغواصات لرؤية سطح الماء – رؤية ما يحدث خلف الجدران – مراقبة التفاعلات الخطرة

1- Periscope: Is used

- 1- In submarines to see what is going on the water surface.
- 2- To see events happening behind a wall or a barrier.
- 3- To monitor the dangerous chemical reactions in laboratory.

الالياف الضوئية : تستخدم فى صناعة المناظير الذى يستخدم فى تشخيص الامراض – تصوير الاصابات – عمليات الليزر

2- Optical fibers:

They are **used** in manufacturing **medical endoscopes** used by doctors to:

- Diagnose some diseases.
- Visualize injuries.
- Doing high-risk operations using lasers.

انكسار الضوء : تغير مسار الضوء عند انتقاله من وسط شفاف لآخر (هواء – ماء) لاختلاف الكثافة الضوئية للوسط

Light refraction: Is the change of light path when it travels from a transparent medium to another transparent medium of different optical density.

الكثافة الضوئية للوسط : قدرة الوسط الشفاف ع انكسار الضوء – كل وسط له كثافة ضوئية خاصة

Optical density of the medium:

It is the ability of the transparent medium to refract the light.

N.B. Each medium has its own optical density.

اختلاف الكثافة الضوئية – نتيجة اختلاف سرعة الضوء من وسط لآخر

G.R The optical density of a medium differs from one medium to another.

Due to the change in the light velocity through such medium.

عندما تزداد الكثافة الضوئية تقل سرعة الضوء خلال الوسط (تناسب عكسى)

* As **optical density** of medium **increases**, the **speed of light** through it **decreases** and vice versa.

زاوية السقوط : الزاوية بين الشعاع الساقط والعمود المقام

Angle of incidence: It is the angle between the incident light ray and the normal line.

زاوية الانكسار : الزاوية بين الشعاع المنكسر والعمود المقام

Angle of refraction: It is the angle between the refracted light ray and the normal line.

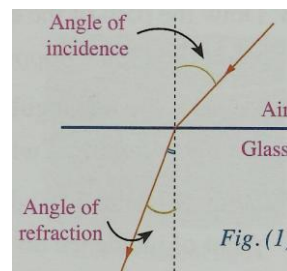
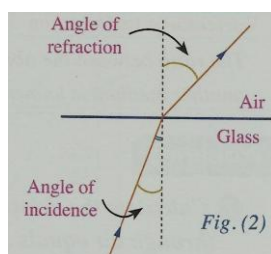
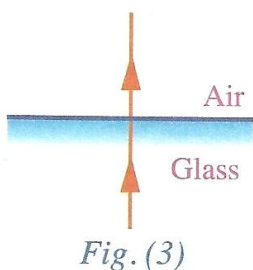
زاوية الخروج : الزاوية بين الشعاع الخارج والعمود المقام

Angle of emergence: It is the angle between the emergent light ray and the normal line.

What is meant by angle of emergence in a prism is 50°

This means that the angle between the emergent ray and the line perpendicular to the interface at the point of emergence is 50°

قوانين انكسار الضوء



Laws of light refraction:

عند انتقال الضوء من وسط اقل كثافة الى اعلى (هواء او ماء الى زجاج) ينكسر قريب من العمود

1- When a light ray travels from a transparent medium of **lower** optical density (air or water) to another of **higher** optical density (glass).

It refracts near the normal.

عند انتقال الضوء من وسط اعلى كثافة الى اقل (هواء الى ماء) ينكسر بعيد عن العمود

2- When a light ray travels from a transparent medium of **higher** optical density (glass) to another of **lower** optical density (air or water).

It refracts far from the normal.

عند سقوط الضوء عموديا ع السطح الفاصل بين وسطين مختلفين – يمر دون انكسار

3- When a light ray falls perpendicular to the interface between two different transparent media.

It passes to the other medium without any refraction.

معامل الانكسار المطلق : النسبة بين سرعة الضوء في الهواء مقسومة ع سرعة الضوء في اى وسط اخر

Absolute refractive index of a medium:

It is the ratio between the light velocity through air to the light velocity through another transparent medium.

$$\text{Absolute refractive index of a medium} = \frac{\text{Velocity of light through air}}{\text{Velocity of light through the medium}}$$

معامل الانكسار المطلق اكبر دائما من الواحد الصحيح – لان سرعة الضوء في الهواء اكبر من سرعته في اى وسط اخر

The absolute refractive index of any transparent medium is always greater than one.

Because the velocity of light through air is always greater than the light velocity in any other transparent medium.

- Problem:

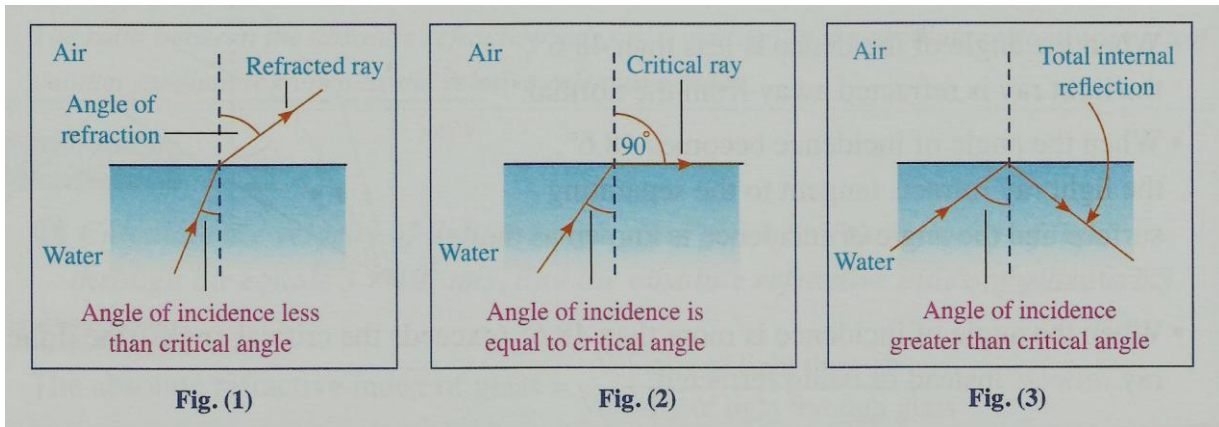
If the velocity of light through water is 2.25×10^8 m/s, calculate the absolute refractive index of water. Knowing that the velocity of light through air is 3×10^8 m/s.

Solution:

Absolute refraction of water = velocity of light in air / velocity of light in water.

$$= 3 \times 10^8 / 2.25 \times 10^8 = 1.33$$

Critical angle and total internal reflection الزاوية الحرجة والانعكاس الكلى الداخلى



عندما تكون زاوية الانكسار = 90° – الشعاع المنكسر يكون مماس (متطابق) ع الخط الفاصل شكل 2
تسمى زاوية السقوط الزاوية الحرجة

*** When the angle of refraction is 90° (the refracted ray is tangent to the interface).**

The angle of incidence is called Critical angle

عند سقوط الشعاع الضوئى بزاوية اكبر من الزاوية الحرجة – ينعكس (انعكاس كلى داخلى) فى نفس الوسط

*** When the light ray is incident with angle greater than the critical angle**

It reflects in the same medium which is known as “total internal reflection”.

الزاوية الحرجة : هى زاوية سقوط من وسط عالى الكثافة الى اقل – تنكسر عند زاوية 90° بالنسبة للعمود

Critical angle:

It is the angle of incidence of a light ray which travels from high optical dense medium to the lower one which results in it being refracted at 90° to the normal.

الانعكاس الكلى الداخلى : هو ارتداد شعاع الضوء عندما يسقط فى وسط اكبر كثافة بزاوية اكبر من الزاوية الحرجة

Total internal reflection:

It is the return of a light ray when it is incident in a medium of larger optical dense by an angle larger than the critical angle of this medium.

ظواهر طبيعية لها علاقة ب انعكاس وانكسار الضوء

Natural phenomena related to light reflection & refraction:

1- Apparent shapes of objects:

ظهور القلم مكسور فى الماء – نتيجة انكسار الضوء

A pencil which is partially immersed in water appears as being broken.

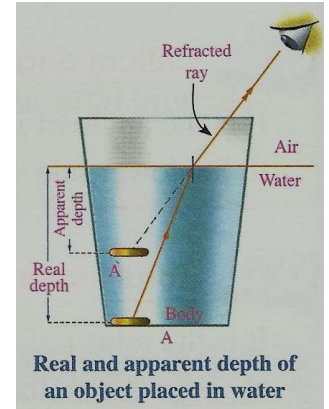
Due to light refraction.

الموضع الظاهرى للجسم : اى جسم فى الماء نراه فى وضع ظاهرى مرتفع عن وضعه الحقيقى

2- Apparent positions of objects:

Any object in water is seen in an apparent position slightly above its real position.

السكة (قاع حمام السباحة) فى الماء تظهر مرتفعة عن وضعها الحقيقى
نتيجة انكسار الضوء – العين ترى امتداد الاشعة المنكسرة



G.R A fish in water seems higher than its real position.

Bottom of swimming pool filled with water seems higher than its true position.

Due to light refraction, eye sees extensions of refracted rays

لكى تلتقط العملة من الكوب المملوء بالماء انظر اليه رأسياً – لان الشعاع العمودى يمر دون انكسار
لذلك الوضع الظاهرى = الوضع الحقيقى

G.R To pick up a coin which is fallen in a beaker, we must look at it vertically.

Because the incident light ray perpendicular to the interface between air and water, it passes without refraction, so the apparent position is the real position.

ظاهرة السراب : ظاهرة طبيعية تحدث فى الصحراء فى الصيف حيث تظهر الاجسام كأنها صور مقلوبة ع مياه

3- Mirage:

It is a natural phenomenon that takes place on the desert roads at noon especially in the summer times.

* Where, objects on the road sides seem as if they had inverted images on a wet area.

اسباب حدوث ظاهرة السراب : نتيجة انكسار الضوء – الانعكاس الكلى الداخلى

Reason for the occurrence of mirage phenomenon:

Due to light refraction and total internal reflection.

Lesson 1: Reproduction in plants

الزهرة : ساق قصيرة معدلة لتكون اجزاء الزهرة المختلفة – عضو التكاثر الجنسي فى النبات الزهرى

Flower: Is a short stem whose leaves are modified to form different parts of the flower

Is the organ of sexual reproduction in flowering plants.

الازهار : مجموعة زهور مرتبة ع نفس المحور (تفتح الزهور)

Inflorescence: Is a group of flowers arranged on the same axle.

قنابة : الورقة التى تنشأ منها الزهرة

Bract: Is the leaf from which the floral bud carrying the flower emerges.

تركيب الزهرة النموذجية

Structure of a typical flower: (4 whorls)

Receptacle: swollen part carries the floral leaves التخت : الجزء المنتفخ خارج الزهرة

الكأس : اول محيط زهرى – اوراق خضراء كل ورقة تسمى سبلة

1- Calyx:

a) It is the first whorl of the floral leaves.

b) It consists of a group of green leaves, each leaf is called a **sepal**.

وظيفة الكأس : حماية الاجزاء الداخلية للزهرة

Its function: It protects inner parts of the flower.

التويج : ثانى محيط زهرى – اوراق ملونة لها رائحة كل ورقة تسمى بتلة

2-Corolla

a) It is the second whorl of the floral leaves.

b) It consists of a group of colorful & scented leaves, each leaf is called a **petal**.

وظيفة التويج : حماية الاعضاء التناسلية – جذب الحشرات

Its function: a) It protects the reproductive organs.

b) It attracts insects.

الطلع : المحيط الثالث – عضو التكاثر الذكري – كل ورقة تسمى سداة – كل سداة تتكون من خيط ومترك (به حبوب اللقاح)

3- Androecium:

a) It is the third whorl of the floral leaves.

b) It is the male reproductive organ of the flower.

c) Its leaves are known as **stamens**.

d) Each stamen consists of filament ends in anther, which contains pollen grains

وظيفة الطلع : ينتج ويحمل حبوب اللقاح

Its function: It produces & holds pollen grains.

المتاع : المحيط الداخلى 4 – عضو التكاثر الانثوى – كل ورقة تسمى كرىلة – تتكون الكرىلة من جزء منتفخ (المبيض) – ثم القلم

تنتهى بفتحة تسمى الميسم

4- Gynoecium:

a) It is the fourth (innermost) whorl of the floral leaves.

b) It is the female reproductive organ of the flower.

c) Its leaves are known as **carpels**, which look like the flask.

d) Each carpel consists of a swollen part called ovary which is connected with a tube called style which ends in an opening called stigma.

وظيفة المتاع : ينتج البويضات داخل المبيض

Its function: It produces ovules (inside the ovary).

جنس الزهرة (مذكر – مؤنث - خنثى)

Sex of flowers:

الزهرة المذكرة : تحتوى ع الطلع فقط مثل النخيل والذرة والقرع

1- Male flowers:

They contain only male reproductive organs (Androecium).

Ex. (Palms, maize and pumpkins)

الزهرة المؤنثة : تحتوى ع المتاع فقط مثل النخيل والذرة والقرع

2- Female flowers:

They contain only female reproductive organs (Gynoecium).

Ex. (Palms, maize and pumpkins)

الزهرة الخنثى : تحتوى ع الاعضاء المذكرة والمؤنثة

3- Bisexual (hermaphrodite) flowers:

They contain both male & female reproductive organs.

Ex. (Tulip, petunia, gelly & wallflower).

التكاثر فى النبات

Reproduction in plants:

التكاثر التزاوجى يحدث فى خطوتين – التلقيح ثم الاخصاب

First: Sexual reproduction in plants:

التلقيح : انتقال حبوب اللقاح من متك (الزهرة المذكرة) الى ميسم (الزهرة المؤنثة)

1) Pollination: Is the process of transfer of pollen grains from the flower anthers to the stigmas.

انواع التلقيح – تلقيح ذاتى (فى نفس الزهرة الخنثى) – تلقيح خطى بين زهرة واخرى

Types of pollination:

1- Self pollination: Is the transfer of pollen grains from anthers of a flower to stigmas of the same flower.

2- Mixed pollination: Is the transfer of pollen grains from anthers of a flower to stigmas of another flower in other plant of the same kind.

طرق التلقيح الخطى : 1- عن طريق الهواء او الرياح بشروط معينة :

المتك معلق فى الهواء (ليفتح بالهواء) – المتك ينتج عدد كبير من حبوب اللقاح (لتعويض ما يفقد فى الهواء)

Methods of mixed (cross) pollination:

1) Pollination by air (wind):

* Anthers of flowers are hanged.

To open by air.

* Anthers produce big numbers of pollen grains.

To compensate pollen grains.

حبوب اللقاح خفيفة وجافة (سهل ان يحملها الهواء) – الميسم ريشى لزج (لكى يلتقط حبوب اللقاح)

* The pollen grains are light in weight and dry.

To be easily carried by air.

* Stigmas are feathery sticky like.

To catch pollen grains from air.

التلقيح عن طريق الحشرات : ورق الزهرة ملون وله رائحة (لجذب الحشرات لاختذ الرحيق)

2) Pollination by insects:

* Petals are colored & scented.

To attract insects to feed on its nectar.

حبوب اللقاح لزجة خشنة (لكي تلتصق بجسم الحشرة

* Pollen grains are sticky, having coarse surface.

To stick on the insect body.

التلقيح الصناعي : بواسطة الانسان فى النخيل

3) Artificial pollination:

This method of pollination is carried out by man. Ex. Palm trees.

الانسان يلقح النخيل : لاتمام عملية التلقيح حيث صعوبة التلقيح عن طريق الهواء والحشرات

* Sometimes, man has to pollinate palm trees.

To ensure pollination process as pollination is difficult to occur by air or by insects.

الاخصاب : عملية اتحاد نواة حبة اللقاح مع نواة البويضة لتكوين الجنين

II) Fertilization: Is process of fusion of nucleus of pollen grain with nucleus of ovum to form the zygote.

انبات حبوب اللقاح – وضع قطرة من محلول السكر ع حبوب اللقاح تنبت وتكون انبوبة التلقيح

Pollen grain germination:

* Place a drop of sugar solution on pollen grains.

The pollen grain germinates by formation of a pollen tube.

مراحل الاخصاب فى النبات : بعد التلقيح تلتصق حبة اللقاح بالميسم – انبات انبوبة اللقاح – تمتد انبوبة اللقاح داخل القلم لتصل للبويضة داخل المبيض – تتحلل الانبوبة وتضع النواة المذكرة التى تتحد مع البويضة مكونة بويضة ملقحة لتكوين الجنين

Stages of fertilization process in plants:

1-After pollination, pollen grain sticks on stigma.

2- Pollen grain germinates forming a pollen tube.

3- Pollen tube extends in style till reaches ovule inside ovary through micropyle.

4- The end of the pollen tube degenerates and one of the 2 male nuclei combines with the ovum forming zygote.

5- Zygote undergoes divisions to form the embryo inside the ovule.

تنمو البويضة لتصبح بذرة – وينمو المبيض ليصبح ثمرة

6- Ovule develops & becomes seed, but ovary develops & becomes fruit.

الثمار تختلف طبقا لطبيعة المبيض : المبيض يحتوى ع بويضة يعطى ثمرة ذات بذرة واحدة (الزيتون والخوخ) – عدة بويضات تعطى عدة بذور (الفاصوليا والبسلة)

Fruits differ from each other according to the nature of the ovary:

* Ovary that contains one ovule, gives a fruit with single seed as **olives and peaches.**

* Ovary that contains many ovules, gives a fruit with many seeds as **beans and peas**

النقير : فتحة دخول النواة المذكرة الى المبيض

Micropyle: position of entrance of male nucleus to ovule inside ovary

التكاثر اللاجنسى فى النبات

Second: Asexual reproduction in plants:

التكاثر الخضرى : يحدث عن طريق اجزاء من الجذور – الساق – اوراق - براعم

Vegetative reproduction:

* It takes place via parts of roots, stems, leaves or buds.

تكاثر خضرى طبيعى : بعدة طرق التكاثر ب الجذور – نخلة صغيرة – درنات البطاطس – ابصال - فروع

1- Natural vegetative reproduction:

*It takes place by many ways such as reproduction by

(Rhizomes - Corms – Tubers –Bulbs –Offshoots).

التكاثر بالدرنات مثل جذر البطاطس – ساق البطاطا

Reproduction by tubers:

The tuber is:

*A root as sweet potatoes - A stem as potatoes.

التكاثر الخضرى الصناعى : التكاثر بالعقلة : جزء من الجذر – الساق – الورقة يأخذ من النبات للتكاثر

2- Artificial vegetative reproduction:

-1 Reproduction by cutting:

Cut: Is a part of root, stem or leaf that taken from a plant for reproduction

Observation:

البراعم تدفن فى التربة لتكون الجذور – البرعم فوق التربة يكون باقى اجزاء النبات – تنتقل الشجيرة الى تربة لتنمو بكفاءة

* The buds buried **inside soil** grow to form the **root system** of the plant.

* The buds **above soil** surface grow to form the **shoot system** of the plant.

* These shrubs are then transferred to soil to grow more efficiently.

التكاثر بالتطعيم : بوضع الطعم (جزء من شجرة) فى جذع شجرة اخرى (لتنمو اسرع او اكبر)

2- Reproduction by grafting:

In reproduction by grafting, an individual plant which containing more than one bud, known as **scion** (graf), is selected to be placed on another individual known as the **stock**.

طرق التطعيم : عن طريق الربط بين الطعم والجذع مثل شجر المانجو

Methods of grafting:

a) Grafting by attachment: In which the scion is attached to the stock.

Ex. **Mango trees.**

طرق التطعيم : عن طريق الحشر بعمل شق لدخول الطعم فى الجذع مثل شجر المانجو – فى الاشجار الكبيرة

b) Grafting by wedge: In which the scion in the form of a wedge (pencil shaped) is inserted into a cleft in the stock. Ex. **Large trees**

الطعم يتغذى ع الجذع

In both methods, the scion and the stock are tightly fled together, where the scion feeds on the juice of the stock.

الثمار الناتجة هى ثمار الطعم

* The produced fruits by grafting belong to the type of the scion.

التكاثر بالتطعيم يستخدم بين النباتات المتشابهة فقط

* Reproduction by grafting is used only between **highly similar plant species**

Such as:

* Orange & naring (or bitter orange). البرتقال والالارنج

* Apples and pears. التفاح والكمثرى

* Peaches & apricots. الخوخ والمشمش

زراعة الانسجة : عملية مضاعفة جزء صغير من النبات للحصول ع العديد من اجزاء متشابهة
مثل زرع قطعة من نبات البطاطس فى سائل به هورمونات

3- Tissue culture:

Is a process of multiplying a small part of a plant to get many identical parts.

Reproduction in humans

الانسان يتكاثر جنسى – اتحاد الحيوان المنوى مع البويضة لانتاج الجنين (مختلف عن الالباء) الجهاز المسنول عن التكاثر يسمى الجهاز التناسلى (المذكر – المؤنث)

1. Like all higher animals , humans can only reproduce sexually. A sperm from a man joins with an egg (ovum) in the woman to produce a new human individual .
2. The offspring is different from the parents.
3. The system responsible for reproduction in humans is called **the genital system**. Male genital system is different in structure & function from female genital system.

Male genital system

الجهاز التناسلى الذكرى يتركب من الخصية – الوعاء الناقل – القناة البولية – القضيب – الغدد التناسلية

Structure: It consists of the testes, vas deferens, the urethra , the penis & the associated glands.

Structure	Description	Function
testes الخصيتين	Two elliptical glands غدد بيضاوية	Produce :a. sperms (male reproductive cell) b. male hormones (testosterone) انتاج الحيوانات المنوية – الهرمون الذكرى
Vas deferens الوعاء الناقل	Looped tubes called epididymis attached to each testicle انابيب رفيعة ملتوية	Growth and store sperms تخزن وتنمى الحيوانات المنوية Transfer sperms from testis to urethra تنقل الحيوانات المنوية من الخصية الى القناة البولية
The associated glands الغدد التناسلية	The seminal vesicle The prostate Cowper's gland الحوصلة المنوية – البروستاتا – غدة كوبر	They secrete seminal fluid which neutralizes the acidity of urethra & nourishes the sperms to keep them alive & help them flow easily . تفرز السائل المنوى الذى يعادل حموضة القناة البولية – تغذى الحيوانات المنوية – تساعد حركتها بسهولة
The penis	Sponge like tissue . The urethra passes through the penis. It ends with the urinogenital	Discharge of semen & urine. القضيب : غشاء اسفنجى – القناة البولية تمر خلاله وينتهى بفتحة مجرى البول وظيفته : تصريف السائل المنوى والبول

الهرمون الذكري (التستسترون) مسئول عن مظاهر البلوغ (نمو شعر الشارب والذقن – تضخم الصوت – نمو العضلات والعظام)

1. **Testosterone** is responsible for the **signs of puberty** which include appearance of moustache & beard, the change of voice & the growth of muscles & bones.

توجد الخصيتين داخل كيس الصفن خارج الجسم – لعزله عن درجة حرارة الجسم لكي ينمو

2. **G.R** The testes are enclosed inside a sac is known as **scrotum outside the body** to keep the temperature of the organ two degrees below the internal temperature of the body. This is the temperature suitable for the growth and development of sperms.

ماذا يحدث للخصية اذا كانت داخل الجسم – تموت الحيوانات المنوية

3. **What happen:** If the testes where kept inside the body and didn't come out during the development of the embryo , **the sperms would die** .

The female genital system الجهاز التناسلي الانثوى

Structure	Description	Function
Two Ovaries المبيضين	Each gland has the size of a peeled almond فى حجم اللوزة المقشرة -	1. Each ovary produces one ovum every 28 days . 2. Secrete female hormones. انتاج البويضات – الهرمون الانثوى
Two Fallopian tubes قناة فالوب	Each tube has a funnel shape & ends with finger like Each tube joins the upper corner of the uterus شكل القمع تنتهى ب اصابع – فى اعلى الرحم	They have muscular walls which contract then relax to push the ovum towards the uterus. لها جدار عضلى لدفع البويضة الى الرحم
The uterus الرحم	Pear shaped hollow organ found in the pelvic cavity. الحوض It has a muscular wall covered with a mucus membrane عضو مجوف يشبه الكمثرى – له جدار عضلى مغطى ب غشاء مخاطى	It protect and feed the fetus (through placenta and umbilical cord) حماية الجنين وتغذيته عن طريق المشيمة والحبل السرى Bec. It has blood vessels have food and O ₂ for embryo.
The vagina المهبل	A muscular tube between the uterus & the external genital opening. انبوب عضلى بين الرحم والفتحة البولية	It expands during labor to deliver the baby يتمدد اثناء الولادة لمرور الجنين

الهرمونات الانثوية : الاستروجين : مسئول عن مظاهر البلوغ الانثوية (نمو الشعر – نعومة الصوت – نمو الثدي – الدورة الشهرية)
البروجسترون : يساعد في بداية واستمرار الحمل

Female hormones:

- 1- **Estrogen** is responsible for the secondary sexual characters in female .
- 2- **Progesterone** is needed for starting & maintaining pregnancy.

Signs of puberty in females: مظاهر البلوغ

1. The growth of hair, softness of voice, fat accumulation, growth of breasts
menstrual cycle every 28 days.
2. Menstrual cycle occurs at teenage and stops at menopause

الدورة تبدأ في سن المراهقة وتنتهي في سن اليأس

المشيمة : اوعية دموية لتمد الجنين بالغذاء والاكسجين عن طريق الحبل السرى

The placenta develops in the uterus , it's a mass of blood vessels which connects the developing fetus to the uterus wall to allow nutrient uptake & gas exchange via mother's blood vessels. It connects to the fetus via the **umbilical cord**.

البويضة : كبيرة ثابتة دائرية (حجم حبة السمسم) تخزن العناصر الغذائية

التبويض : انتاج البويضة (كل مبيض ينتج بويضة واحدة بالتبادل مع الآخر كل 28 يوم)

- **The ovum is the female reproductive cell** It is a large static spherical cell (the size of a sesame seed) that stores nutrients.
- **Ovulation** is the production of ovum from the ovaries every 28 days.

The structure of the ovum	
Nucleus	It contains half the genetic material. نصف المادة الوراثية.
Cytoplasm	It stores nutrients يخزن العناصر الغذائية
Cell membrane	Coating the cell يحيط بالخلية

الحيوان المنوى : رأس تحتوى نصف المادة الوراثية –الجسم به مركز للطاقة لحركة الحيوان المنوى – الذيل يساعده ع العوم تجاه البويضة

The sperm is the male reproductive cell

The structure of the sperm	
Head	It contains half the genetic material.
Middle part	It contains mitochondria that release energy needed to move the sperm.
Tail	It helps the sperm to swim towards the ovum.

النواة بها المادة الوراثية (الكروموسومات) – التى تحمل الجينات (مسئولة ع الصفات الوراثية) – الخلايا التناسلية بها نصف المادة الوراثية

1. The body of the living organism consists of cells.
2. The nucleus in the cell contains the genetic material called chromosomes.
3. The chromosomes carry **genes** responsible for the hereditary traits.
4. The number of chromosomes for a certain species is constant. Humans have 46 chromosomes arranged in 23 pairs in all cells except reproductive cells which have half the number of chromosomes (23).

P.O.C.	Somatic cells جسدية	Reproductive cells
Examples	Muscle cells , skin cells	Ovum & sperms
No. Of chromosomes	Full number of chromosomes	They contain half the genetic material.

الحيوان المنوى : رأس تحتوى نصف المادة الوراثية –الجسم به مركز للطاقة لحركة الحيوان المنوى – الذيل يساعده ع العوم تجاه البويضة

خطوات الاخصاب : الحيوان المنوى يفرز مادة لازابة جدار البويضة للدخول – البويضة تغلق لعدم دخول حيوانات اخرى
تتحد نواة الحيوان المنوى والبويضة لتكون البويضة المخصبة (الزيجوت) يحتوى ع المادة الوراثية كاملة

Steps of fertilization

1. The sperm secretes a material that dissolves wall of the ovum penetrating it.
2. The ovum encloses itself by a membrane to prevent the entry of other sperms.
3. The nuclei of the sperm and ovum fuse together to form the fertilized ovum known as the **zygote** that contains a nucleus with 23 pairs of chromosomes.

Fertilization: fusion nucleus of male gamete with female gamete to form zygote.

Development of the embryo

1. The development of the fetus (embryo) occurs in 9 month divided into 4 stages:

	Duration	Development of embryo
The first stage	The first 6 weeks of pregnancy	Formation of a head & eyes. تكوين الرأس والعين
The second stage	7th week till 12th week of pregnancy	The face , genital organs & digits appear الوجه – الاعضاء التناسلية – الاصابع
The third stage	13th week till it the 22nd of pregnancy.	1. Development of bones & circulatory system. 2. The embryo movements are felt by the pregnant mother. العظام – الجهاز الدورى – الام تشعر بالحركة
The fourth stage	23rd week till delivery.	All body systems are completely developed through this stage. كل اجهزة الجسم تنمو بشكل كامل

الجنين يمكن ولادته بعد 28 اسبوع لان الجهاز التنفسي يستطيع تنفس الهواء – عند نمو الجنين يقلب رأسه تجاه عنق الرحم

1. The fetus could be delivered by the twenty eighth week because its respiratory system can breathe atmospheric air.
2. When the embryo is completely developed, it inverts its position with the head towards the cervixes of the uterus.

Diseases of the genital system

امراض الجهاز التناسلى

حمى النفاس puerperal fever-sepsis disease	
The microbe	Spherical bacteria بكتريا دائرية
Means of infection طرق الإصابة	Bacterial infection of the female reproductive system after child birth. إصابة الانثى فى الجهاز التناسلى بالبكتريا بعد الولادة
Incubation period فترة الحضانة	1-4 days
Symptoms الاعراض	Increase in body temperature, chilling, pallor, severe acute pains in the lower abdomen associated by secretions from the uterus with bad smell. ارتفاع الحرارة – رعشة – اصفرار – ألم فى البطن – افرازات فى الرحم لها رائحة كريهة
Prevention الحماية	Sterilizing surgical tools. Avoiding contact with patients. The mother should avoid exposure to cold air currents. تعقيم ادوات الجراحة – عدم الاتصال مع المرضى – البعد ع التيارات الهوائية

فترة الحضانة : هى الفترة بين بداية الإصابة وظهور اعراض المرض

Incubation period is the period of time between beginning of infection and appearance of symptoms on the patient.

Syphilis disease مرض الزهري	
The microbe	Spiral bacteria بكتريا حلزونية
Means of infection	Syphilis bacteria are transferred from an infected person by sexual contact. The bacteria can be transferred from the pregnant woman to her embryo. الاتصال الجنسي – من الام الى الجنين
Incubation period	2 to 3 weeks
Symptoms	- The formation of a painless hard ulcer on the genital organs. - Dark brass colored rash appears on the back and hands. ظهور قرحة صلبة ع الاعضاء التناسلية غير مؤلمة – طفح وردي ع الظهر واليد
Complications المضاعفات	- Tumors in different parts of the body like of the liver, bones and parts of the genital system. - The brain may also be damaged and the patient will die. اورام في الكبد – العظام – الاعضاء التناسلية – موت المريض وتلف المخ

Diseases don't arise from sexual contact امراض ليس لها علاقة ب الاتصال الجنسي

Uterine cancer – prostate cancer – puerperal sepsis حمى النساء – سرطان الرحم – سرطان البروستاتا

Diseases arise from sexual contact امراض لها علاقة ب الاتصال الجنسي

AIDS – syphilis – Gonorrhea الزهري – السيلان – الايدز

Effect of smoking and addiction on genital system تأثير التدخين والادمان ع الاعضاء التناسلية

- 1- Decrease male and female hormones قلة الهرمونات
- 2- Death of embryo_ موت الجنين
- 3- Deformation of embryo_ تشوه الجنين

غطاء التواليت الطبي – لتجنب الاصابة بأمراض الجلد والأمراض التناسلية

Healthy toilet seat cover

A plastic medical cover in the form of an elliptical plastic frame - sold in pharmacies - should be used in public toilets **to avoid infection by some skin and genital diseases.**